

Amendments to the Claims:

Claim 1 (currently amended): A system for fingerprint authentication, comprising:
a curve recognition system for storing, regenerating or matching a shape of a
fingerprint ridge by using a specified group of data including one of a length, angle and
position to express a shape of the ridge, wherein
the curve recognition system uses a minutia and a sequence of several measure
points on the fingerprint ridge selected so that chords connecting the adjacent measure points
are of equal length, the shape of the fingerprint ridge is characterized by data of lengths of
chords between a starting measure point and an ending measure point for every 3 consecutive
measure points on the ridge.

Claim 2 (previously presented): The system as defined in claim 1, wherein the curve
recognition system is provided for recognition of the ridge expressed on a discrete grid in the
form of an array of pixels in a digital image, which determines position of the measure points
by interpolating positions of two nearest adjacent pixels on the ridge, wherein the starting
measure point divides a length of a chord between the two nearest adjacent pixels at the ratio
of lengths from a standard pixel on the curve to each of the nearest adjacent pixels.

Claim 3 (previously presented): The system as defined in claim 1, further comprising in a sequence of processing:

means for block partitioning to partition whole image data into plural pieces of blocks;

means for the first binarization to make gray scale image a binary black and white image by enhancing contrast of original image;

means for deriving directions of the ridge in binary image;

means for noise elimination to eliminate black data not located along directions of ridge;

means for the second binarization to make gray scale image a binary data by enhancing contrast of original images;

means for thinning by reducing width of ridge until ridge width becomes one pixel in size;

means for false minutia elimination to eliminate plural minutiae located closely to each other, an ending minutia located near bifurcation minutia, a minutia located closely to image boundary, and an isolated minutia without ridge, and

means for extracting minutia to adopt remaining minutia as true minutia after above false minutia elimination.

Claim 4 (previously presented): The system as defined in claim 1, wherein the system utilizes, as an additional feature of fingerprints, both the ridge shape and the ridge shape of a secondary minutia, whose position is determined in association with each minutia.

Claim 5 (previously presented): The system as defined in claim 3, further including two kinds of extraction means for an ending minutia performed using the original black and white image and an inverted version of the original black and white image, instead of extracting both ending and bifurcation minutia using just the original black and white image.

Claim 6 (previously presented): The system as defined in claim 1, further including a cost effective calculation for judging true or false minutia, comprising:

means for taking two-dimension coordinates with respect to an origin located at a bifurcation point;

means for taking 3 points on different ridges leaving from the bifurcation point with the same distances from the bifurcation point;

means for calculating inner products of all pairs of point-vectors that can be obtained from the 3 point-vector that correspond, respectively, to the 3 points;

means for judging the bifurcation as a false bifurcation minutia if all calculated inner products are less than a specified value, and, otherwise, judging the bifurcation as a true bifurcation minutia; and

means for judging ridge ending as a false ending minutia by using the inner products over valleys if all inner products are less than a specified value, and, otherwise, judging the ending minutia as a true ending minutia.

Claim 7 (previously presented): The system as defined in claim 1, wherein different parts of the fingerprint image are processed in a way to generate numerical data for each frame input of the fingerprint image and processing of a whole fingerprint image is completed for plural frame inputs of the fingerprint image.

Claim 8 (cancelled).

Claim 9 (canceled)

Claim 10 (currently amended): The system as defined in claim 7, wherein the system it takes 6th frame in a raster scan system of 25 frames per second to complete processing from image capture to numerical processing, which corresponds to input time of 6 or 7 frames.

Claim 11 (previously presented): The system as defined in claim 1, comprising:
means for extracting numerical data of the fingerprint ridge shapes of the ridge leaving from the minutia; and
means for matching the numerical data with template samples registered in advance in a fingerprint database.

Claim 12 (previously presented): The system as defined in claim 1, wherein a computer performs a sequence of processing including thinning, compensation, binarization, thinning, collection and matching of fingerprint feature data expressed by 40 or 60 bytes data in size.

Claim 13 (previously presented): The system as defined in claim 1, further comprising:

means for extracting fingerprint feature data of 40 or 60 bytes from a fingerprint template transferred from an outer device or terminal equipment; and
means for transferring result of matching with the templates through communication network to the outer device or terminal equipment.

Claim 14 (previously presented): The system as defined in claim 1, wherein the system is used with one of a terminal or stand-alone equipment for personal history, a key lock, an issue of various tickets, an access control and toll of gates, electric commerce, and a fund management in medical, social welfare, service, public service, and financial organization.

Claim 15 (currently amended): The system as defined in claim 1, wherein the system is embedded in hardware or software as a part of design data protection, the and wherein use of the hardware or software requires personal authentication with fingerprints.

Claim 16 (previously presented): The system as defined in claim 1, wherein a criterion of acceptance is determined by logic operations performed on or utilizing extracted feature data of plural fingerprints.

Claim 17 (previously presented): The system as defined in claim 10, further comprising:

means for rotating coordinates of all minutiae to a rotation angle around a specified origin point;

means for compensating a minutia ridge shape for rotation to the rotation angle; and

means for employing fingerprint matching without compensation for displacement of fingerprints.